

Evolutionary changes in the periods of galactic RRab stars

Vandenbroere, J., Poretti, E., and Le Borgne, J.F.

Abstract Le Borgne et al. (2007) report on the determination of evolutionary changes in the periods of field RR Lyr stars. Thanks to the extension of the GEOS database, we could analyze a sample twice larger than the previous one. We obtained a different picture of the period changes, with a number of stars showing an increasing period twice greater than that of stars showing a decreasing period.

The amateur/professional association GEOS (Groupe Européen d’Observations Stellaires) built a database aimed to put together the times of maximum light of RR Lyr stars published in the literature, coming back to end of XIXth century. The analysis of the differences between the *observed* and *calculated* times of maximum brightness (O-C values) over a timescale of more than 100 years is one of the few tool able to provide quantitative tests of the stellar evolution theory. The GEOS database is freely accessible on the internet at the address <http://rr-lyr.ast.obs-mip.fr/>.

Le Borgne et al. (2007) analyzed 123 galactic RRab stars showing a clear O–C pattern (constant, parabolic or erratic) and found clear evidence of period increases or decreases at constant rates, suggesting evolutionary effects. One of the most in-

Vandenbroere, Jacqueline
GEOS, 23 Parc de Levesville, 28300 Bailleau l’Eveque, France. e-mail: j.vandenbroere@skynet.be

Poretti, Ennio
INAF-OA Brera, Via E. Bianchi 46, 23879 Merate, Italy. e-mail: ennio.poretti@brera.inaf.it

Le Borgne, Jean-Francois
Institut de Recherche en Astrophysique et Planétologie, 14 Avenue E. Belin, 31400 Toulouse, France. e-mail: jean-francois.leborgne@irap.omp.eu

teresting results was that RRab stars showing blueward evolution (i.e., period decreases) are quite common, slightly less than RRab stars showing redward evolution (i.e., period increases). The number of maxima of RRab stars in the GEOS database increased rapidly in number and precision thanks to the survey performed with the TAROT telescopes and by amateur astronomers equipped with CCDs. Therefore, a few years later we could double the number of with obvious period variations [1].

To date, we have studied the evolution of the period of 217 RRab stars for which at least 20 times of maximum spanning 50 years are available. Table 1 summarizes the results. The incidence of stars with decreasing periods is still relevant and we could confirm that the blueward path has a non-negligible part in the evolution of horizontal branch stars. The new fact is that the number of RRab stars with increasing periods is now clearly larger than that of stars with decreasing periods. This partially solve one of the problems raised in the previous analysis, i.e., the necessity to invoke a fast redward evolution to explain the small ratio between the number of stars with increasing period and that of stars with decreasing period.

We note that this statistics is based on stars showing a constant rate, which could be determined in a very reliable way and then straightly referred to evolutionary effects. Erratic or irregular changes are more difficult to be put in a precise evolutionary scenario.

Table 1 Statistics of RRab stars showing period changes due to evolutionary effects

Type of Period	Number of stars	Percentage [%]	Mean dP/dt [10^{-10} d/d]
Constant	104	48	
Increasing	56	26	+6.83
Decreasing	28	13	-10.53
Irregular	29	13	

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References

1. Le Borgne, J.F., Paschke, A., Vandenbroere, J. et al.: A&A **476**, 307 (2007)